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(54) Title: FLOCKED FABRIC PRINTING

(57) Abstract

A flocked fabric has colors with long wearing capabilities and includes a textile substrate and raised disperse-dyeable fibers adhered to the substrate, an opaque particulate colorant adhering to the raised fibers and arrayed on the fabric in a printed pattern. A dye other than the opaque particulate colorant is also arrayed on the fabric in other portions of the printed pattern, such as in a blotch. A melamine-latex binder system causes the opaque particulate material to adhere to the fibers, and a resist causes the other dye not to dye the fibers in the area of the malamine-latex binder system. The opaque particulate colorant is adhered to the fibers strongly enough to show only very little wear after 15,000 cycles on a Wyzenbeek abrasion test.

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FLOCKED FABRIC PRINTING

Background of the Invention

The present invention relates to improvements in printing fabrics such as flocked fabrics or velvets, although it is also applicable to other types of fabrics.

Velvets and flocked fabrics have a substrate with the fibers standing up from the substrate, which give the fabric a soft, luxurious, fluffy feel. These fibers also, however, cause problems when it comes to printing the fabric with a decorative pattern or other pattern. That is, since the top surface of the fabric has vertically extending fibers, it is difficult to thoroughly print the fabric without having grin through of the substrate and other undesirable attributes.

This has typically been alleviated by using a very high wet pick-up of dyes and print materials on the fabric in order to achieve thorough saturation of the fabric with the dyes and other print materials to be used. In a print, however, it is important to obtain registration between the various colors to be printed in the pattern, and this is made more difficult by the presence of the nap on the fabric. Where one color should end and the other begin cannot be as precisely defined on a napped fabric as a flat fabric.

As a result, it has become commonplace in printing fabrics of this type to use blotches as one of the colors of the print. A blotch will tend to be a predominant color in the print, constituting a background for the most part. Blotches can be either fitted or full, and the desirability of one or the other depends upon the nature of the pattern to be printed. Where the other colors of the pattern tend to be contiguous so that they are working together forming a contiguous print, a fitted blotch which covers all the other areas of the fabric is suitable. Where the pattern is more dispersed, a full blotch is used in which the printed and unprinted areas are overprinted by the blotch in ord r to obtain thorough coverage. In a full blotch, a

resist is added to the print paste for the print pattern in order to prevent the blotch from fixing in the areas of the pattern. Then, when the fabric is washed following fixing, the excess dye from the blotch will be washed away.

However, some of the dye from the blotch will, inevitably, fix in the areas of the print, darkening the print and giving it a muted or muddy look. As such, prints on napped fabrics of this sort tend to be dark and the colors not particularly distinctly defined, due to some presence of the blotch.

It is known to apply a solid color dye to fabrics of this sort followed by application of a print pattern with a print paste having a discharge agent which takes away the "blotch" color and replaces it with the desired color in the area of the print. This in known as discharge printing, but still achieves only relatively muted shades. It is known in some circumstances to also apply a gold overlay while applying the discharge print paste, but such gold overlay constitutes a thin, not strongly adherent top layer of gold to the tips of the fibers. The gold is, accordingly, not very wear-resistant. Furthermore, the cost involved in the two-step discharge printing is considerable.

Accordingly, there is a need in the art for a napped fabric having improved color brightness and distinctness in its print, and an improved process for manufacturing such fabric on a cost-effective basis.

Summary of the Invention

The present invention fulfills this need in the art by providing a fabric having colors with long wearing capabilities including a textile substrate, raised fibers on the substrate, an opaque particulate colorant adhering to the raised fibers and a melamine-latex binder system causing the opaque particulate material to adhere to the fibers. Preferably, the fabric is a flocked fabric such that the raised fibers adhere to the substrate.

Alternatively, the fabric can be a velvet fabric such that the raised fibers extend from yarns in the substrate. Other napped and flat fabrics may also be used.

Examples of suitable opaque particulate colorants are gold, bronze, pearlescent metals and titanium dioxide. The colorant adheres to the fibers strongly enough to show only very little wear after 15,000 cycles on a Wyzenbeek abrasion test.

In the preferred embodiment the colorant is arrayed on the fabric in a printed pattern. If desired, the printed pattern includes areas dyed with a dye other than the opaque particulate colorant. If so, it is desirable to provide the melamine-latex binder system with a resist to cause the other dye not to dye the fibers in the area of the melamine-latex binder system. In a particularly preferred embodiment, the dye is provided in a blotch, either fitted or full, which assures full coloration of the fabric. The resist, however, minimizes the fixing of the dye from the blotch in the areas of colorant. When the colorant is white, such as titanium dioxide, the whiteness counteracts color from the blotch which may fix, brightening the print.

In a particularly preferred embodiment, the fibers are disperse-dyeable, and a disperse dye is included in the opaque particulate colorant to dye fibers contacted by the opaque particulate colorant. This can be used with a blotch to good effect. When disperse dyes are used in the colorant with a blotch, the white particulate colorant lightens the fibers to counteract darkening caused by the blotch, so the color from the disperse dye is more apparent.

The invention also provides a process of printing a napped fabric to achieve a long wearing coloration of the fabric. The process includes making up a print paste of an opaque particulate colorant and a latex-melamine binder system, applying the print paste to the fabric and curing the latex-melamine binder syst m to adhere the opaque

particulate colorant to the fabric. Preferably, the making up step includes mixing the colorant, a latex solution, a melamine solution, and thickeners in proportions to achieve a viscosity of at least about 15,000 centipoise. In order to expedite the curing step, the making up step further includes mixing in a catalyst for the latex-melamine binder system.

Typically, the curing step includes exposing the fabric to a temperature of at least about 300 degrees Fahrenheit for at least about three minutes, although the curing is desirably correlated with the catalyst added.

Preferably, the applying step includes applying the print paste in a wet-on-wet printing process, which may also desirably include applying dyes which dye differently than the print paste, such as a blotch. If so, the making up step preferably includes mixing into the print paste a resist which prevents the dyes from dyeing the fabric contacted by the print paste. If other dyes are used, the process desirably includes fixing the dye after the applying step. The fixing step may take place between the applying and curing steps, or may follow curing.

Preferably the other dyes are acid dyes, but other dyeing systems may be used.

In one embodiment the making up step includes adding a dye to the print paste. When the fibers are disperse-dyeable, the dye is preferably a disperse dye. The disperse dye is, of course, not affected by a resist added to the print paste which is effective to resist dyeing of the fibers with the acid dye.

Brief Description of the Drawings

Figures 1 and 2 are photographs of prior art fabrics.

Figures 3-6 are photographs of fabric printed in accordance with the invention.

Detailed Description of the Preferred Embodiments

The improved process and product of the subject invention are made possible by an improved print paste formulation which can strongly adhere opaque particulate colorant materials to the fibers of the fabric. The preferred formulation operates on the basis of a melamine-latex binder system, somewhat along the lines of other melamine binder systems used in the art in textile printing. However, the present formulation has been found to provide particularly strong wear-resistant properties for the particulate colorant on the flocked fabric.

A preferred melamine is the Cyres 963 melamine resin solution available from American Cyanamid Co. of Bound Brook, NJ. A preferred acrylic latex solution is Hycar 26419 available from B.F.Goodrich Co. of Avon Lake, Ohio. These are generally blended in an aqueous solution with a carboxylated thickener-solution, preferably 957 Paste available from Polymer Industries, Div. of Morton-Thiokol of Greenville, SC. This three-component system is further combined with a catalyst for the latex melamine cross-linking necessary for the binder system, and a preferred catalyst is paratoluene sulfonic acid (PTSA), along with a resisting agent which is Thiotan TR, available from Sandoz Chemicals Corp. of Charlotte, NC. These components can be blended together with a white RA paste of titanium dioxide available from Mobay Co. of Rock Hill, SC, which serves as the opaque particulate colorant. If desired, an additional colorant, preferably a disperse dye, may be added to this paste, with the disperse dye being provided primarily to dye the disperse dyeable nylon or polyester fibers of the flocked fabric.

Preferably, the Hycar 26419 is made up in a solution so that it forms a soft polymer, that is with T_g of about -30. In the process, the latex solution is added to the thickener and mixed together. Then, the melamine solution is added, followed by the catalyst. Then, the viscosity is

checked and if too low, additional thickener is added to raise the viscosity to 15,000 +/- 3,000 centipoise. This is followed by the addition of the resisting agent and the titanium dioxide. Agitation continues for 5 minutes or so to assure thorough mixing. A further viscosity check is undertaken and an additional thickener is added if necessary to raise the viscosity. This thickener is desirable for its good hysteresis properties, such that under a shear, it will readily flow and then return quickly to a viscous state. This characteristic is very helpful in screen printing, so that the print paste will be readily applied to the fabric, but then not migrate once it is applied.

The print paste described above is used for one or more colors in a multi-color wet-on-wet printing process, such as a rotary screen or flatbed printing process. Suitable apparatus for carrying out the process is commonly available in the textile industry, such as equipment available from Johannes Zimmer Maschin of Klagenfurt, Austria. If desired, multiple stages of the printing operation may be provided with a print paste according to this formulation or only one color may be with this formulation, with other stages being provided with more conventional print paste. Desirably, a last stage provides a blotch coverage, either a fitted blotch or a full blotch. Particularly with a full blotch, the resist agent which has been added to the print paste should be selected to resist fixation of the dyestuff of the blotch.

The fabric, having had the dyestuff applied in its patterns according to the various stages of the printing apparatus and the blotch, is then dried to reduce further migration of dyes. Depending on the nature of the other dyes applied, either the fabric is cured or fixed. When the other dyes are acid dyes and other dyes suitably fixed by steaming, it is desirable to steam the fabric to fix those dyes. The resist in the print paste described above will prevent substantial fixation of the dyes from the

blotch in the area of the print paste. Following fixation of those dyes, the print paste described above can be cured by exposure to dry heat at about 300-305 degrees Fahrenheit for three minutes. The curing causes the cross-linking of the melamine and latex to securely bond the particulate colorant to the fibers of the flocked fabric. The melamine and latex will support higher temperatures and cure faster, typically temperatures up to 350 degrees Fahrenheit, but such hot temperatures can have deleterious effects on the fibers, so that slower fixation at the lower temperature is preferred. The proportion and nature of the catalyst added will also affect the curing rate.

The fabric is desirably cured by passing through a tenter frame operating at a high enough temperature, so its residence time is effective to achieve curing of the binder system.

The cured fabric is then scoured to remove unfixed dye, including soaping in an alkali treatment. The fabric is then provided with a durable softener, preferably an amino functional silicone, followed by brushing with a nylon bristle brush to raise and smooth the nap.

It has also been found that the curing step can precede fixing.

In another preferred embodiment, the print paste binder system is made up of a hydroxy propyl methyl cellulose (HPMC), such as Methocel K4MS, available from Dow Chemical Co. of Midland, Michigan, a hydroxyethyl cellulose (HEC) such as QP300 available from Union Carbide Corp. of South Charleston, West Virginia. The preferred catalyst is again PTSA along with 92% water, to make a stock paste. This stock paste is made by first adding the HPMC and HEC to the water slowly under medium agitation. Then aqueous ammonia is added to raise the pH to 9.0 +/- .5 followed by the addition of the melamine resin and the catalyst.

To this stock paste is then added a metallic liquid in a pearlescent pigment. Suitable pigments are pearlescent particles available from EM Industries of Hawthorne, NY.

Metals such as particulate gold or bronze available for M.R. Booth of Ashland, Massachusetts may also be used.

This print paste can be used like the other, although it desirably is applied as the last color or just before the blotch in the wet-on-wet process, so that the print paste is not adulterated with other materials. This enhances the brilliance of the metallic material being applied.

One of the advantages of use of the 957 thickener is that when its pH is 9 or so, it is highly viscous, as desired for its role as a print paste. When dried, however, its pH drops to about 2, which helps to fix the acid dye in the nylon.

One of the advantages of the HPMC for use with the gold printing is that as it dries, its viscosity increases, which helps to raise the gold to the surface of the fibers so that it stands out and is more visible. This is to be contrasted with the role of most other thickeners which lose viscosity as they are heated and would tend to permit the gold to drop down toward the substrate where it would be less visible. Additionally, HPMC and HEC do not dry out rapidly on the printing screens, so that they do not lose their consistency over an extended printing run.

The following formulation has been found to be desirable as a stock paste for gold printing (all percentages by weight):

0.5% methocel K4MS
3.5 % QP 300
3.0 % Cyrez 963
0.5% PTSA 10% solution
92% water

Desirably, this stock paste is mixed 50/50 with the Hycar 26419 to make the print paste. The print paste may be combined in a 80:20 proportion with metallic liquid to make the print paste.

An alternative stock solution for gold printing is as follows:

8.8 lbs. QP300

1.1 lb. HPMC

4.4 lb. Cyrez 963

2.2 lb. PTSA 10% solution

203.5 lb. water

This stock solution can be blended with the gold and the Hycar 26419 in the range of 20-44 lbs. of gold, 99-88 lbs. of stock and 99-88 lbs. of 26419.

The same stock solution can be used for the titanium dioxide printing using a formulation of 44 lbs. of titanium dioxide, 77 lbs. of stock, 77 lbs. of 26419, and 22 lbs. of Thiotan resist.

For the printing of colors, 187 lbs. of stock can be combined with 22 lbs. of 26419, 11 lbs. of titanium dioxide and the amount dyestuff as desired to make a print paste.

The relative portions of the melamine latex binder and colorant compared with the thickener will affect the hand of the finished product. If desired to make a distinctly stiff hand, as may be desired to simulate embossed outline lines in the patterned fabric, a formulation of 20% titanium dioxide and 50% binder, along with approximately 30% thickener can be used. A softer hand is obtained with a 5% titanium dioxide, 10% binder and 10% resist formulation. The resist material tends to provide softness as well as resisting properties.

The fabric made according to the present invention is very wear-resistant and suitable for use as upholstery fabric. The fabrics printed with the gold have been tested in a Wyzenbeek tester for up to 15,000 cycles with only very little wear being experienced.

The printing screens used with the above formulation will, of course, be dependent upon the particulate size being used, although there has been found that a 60 mesh screen is suitable for printing with the titanium dioxide, but the gold or pearlescent materials require about a 40 mesh screen.

The binder system of the present invention has been used with conventional pigmented materials with limited success. Apparently, the pigments appear not to be bound to the fabric as strongly as the opaque particulate colorants.

One particularly preferred embodiment of the invention uses various positions of the printing mechanism to print various colors. Each color is provided by the print paste in which the titanium dioxide provides whiteness to the fibers. A disperse dye in each print paste penetrates the nylon fibers of the fabric to dye them a color which is highlighted by the adhered titanium dioxide. This provides a much brighter and luminous print, even when an overprint of blotch follows.

Typically, by the time the fabric has gone through all of the stages of the printing mechanism, it has 100-180% wet pickup.

The fabrics printed according to this invention are readily washable and dry-cleanable.

The photographs making up the drawings of this application illustrate the effects obtainable with the invention and distinguish them from those obtained with the prior art. Figures 1 and 2 are photographs of prior art fabrics in which the coloration is applied to the fabric in conventional fashion. The thus dyed fabric is discharge printed with discharge print paste and gold, which shows up as the highlighted lines in the pattern in both photographs. As can be seen, the background coloration is muted, diffuse and not particularly distinctive. This does result in a highlighted gold, but it is an expensive procedure to make such a second application to already dyed fabric.

The fabric of Figure 3 is made in accordance with the invention in which the whites lines apparent in the pattern are applied using a white print paste as described above and th coloration is applied with conventional print paste, all in a single pass through a rotary screen

printer. As can be appreciated from viewing the photograph, the pattern is muted, but is highlighted by the strong opaque particulate colorant lines put down using the present invention. This provides a brilliant look to the otherwise muted fabric. In addition, the particulate material as adhered to the fibers causes them to have a slightly different texture than the other surface of the napped fabric to provide an interesting tactile effect, as well as the visual aesthetics.

The photograph of Figure 4 illustrates a fabric printed with a generally black blotch and overprinted in a wet-on-wet process with a relatively random gold spatter, using a gold print paste as described above. This results in a bold looking fabric with the black background being highlighted with the brilliant gold surface. Also seen in the photograph of Figure 4 is a strip of the fabric which has been subjected to 15,000 cycles in a Wyzenbeek abrasion test. Almost no change in the gold pattern can be seen in the photograph. The actual fabric does show a bit more wear than is apparent in the photograph, but still the degree of wear is quite minimal, illustrating the strong binding of the gold particulate material to the fibers.

Figure 5 is a photograph of another fabric made in accordance with the invention in which all of the pattern print pastes are made using formulations in accordance with the invention, with a black blotch of conventional formulation. The coloration of the flower petals and leaves shown in the photograph is made using a white print paste according to the invention, dyed with disperse dyes to dye the fibers to which the white is adhered. The resulting coloration is much more brilliant and sharp than the corresponding coloration seen in Figures 1 or 2 which show the prior art fabrics. The coloration is provided in something of a rectilinear pattern, as part of the pattern, rather than as an artifact of the printing process. The outline in the fabric surrounding the leaves and flower

petals is made with a gold particulate according to the invention as described above.

Figure 6 is a photograph of yet another fabric in accordance with the invention in which all of the coloration is made using the invention, but with a conventional black blotch. Again, the white printing formulation according to the invention as described above was used at various stages in the wet-on-wet machine, with disperse dyes to provide the color in the pattern. This was overprinted with a black blotch of conventional formulation. The result is a striking print in which line detail of the colors is discernible, especially seen in the horizontal and vertical lines in the background of the fabric. The print has strong coloration and brilliant color, unlike the muted and diffuse colors of the prior art prints of Figures 1 and 2.

As can be appreciated, the invention provides numerous possibilities for effecting brilliant new print colors for velvets, flocks and other napped fabrics, with or without a blotch overprint.

What is claimed is:

1. A fabric having colors with long wearing capabilities comprising a textile substrate, raised fibers on said substrate, an opaque particulate colorant adhering to said raised fibers and a melamine-latex binder system causing said opaque particulate material to adhere to said fibers.

2. A fabric as claimed in claim 1 wherein said fabric is a flocked fabric such that said raised fibers adhere to said substrate.

3. A fabric as claimed in claim 1 wherein said fabric is a velvet fabric such that said raised fibers extend from yarns in said substrate.

4. A fabric as claimed in claim 1 wherein said opaque particulate colorant is selected from the group consisting of gold, bronze, pearlescent metals and titanium dioxide.

5. A fabric as claimed in claim 1 wherein said colorant is adhered to said fibers strongly enough to show only very little wear after 15,000 cycles on a Wyzenbeek abrasion test.

6. A fabric as claimed in claim 1 wherein said colorant is arrayed on said fabric in a printed pattern.

7. A fabric as claimed in claim 6 wherein said pattern includes areas dyed with a dye other than the opaque particulate colorant.

8. A fabric as claimed in claim 7 wherein said melamine-latex binder system includes a resist to cause said other dye not to dye the fibers in the area of said melamine-latex binder system.

9. A fabric as claim d in claim 1 wherein said fibers are disperse-dyeable and a disperse dye is included in said opaque particulate colorant to dye fibers contacted by said opaque particulate colorant.

10. A fabric as claimed in claim 9 wherein said colorant is arrayed on said fabric in a printed pattern.

11. A fabric as claimed in claim 10 wherein said pattern includes areas dyed with a dye other than the opaque particulate colorant.

12. A fabric as claimed in claim 11 wherein said melamine-latex binder system includes a resist to cause said other dye not to dye the fibers in the area of said melamine-latex binder system.

13. A fabric as claimed in claim 1 wherein said fibers colored by said opaque particulate colorant are stiffened by said colorant and/or said binder system.

14. A fabric as claimed in claim 9 further comprising a blotch of color on the fabric and resist in the colorant resists fixation of said blotch.

15. A flocked fabric having colors with long wearing capabilities comprising
a textile substrate,
raised disperse-dyeable fibers adhered to said substrate,
an opaque particulate colorant selected from the group consisting of gold, bronze, pearlescent metals and titanium dioxide adhering to said raised fibers and arrayed on said fabric in a printed pattern,
a dye other than said opaque particulate colorant arrayed on said fabric in other portions of said printed pattern,
a melamine-latex bind r system causing said opaque particulate material to adhere to said fibers and a resist

to cause said other dye not to dye the fibers in the area of said melamine-latex binder system,
wherein said opaque particulate colorant is adhered to said fibers strongly enough to show only very little wear after 15,000 cycles on a Wyzenbeek abrasion test.

16. A process of printing a napped fabric to achieve a long wearing coloration of the fabric comprising making up a print paste of an opaque particulate colorant and a latex-melamine binder system, applying the print paste to the fabric and curing the latex-melamine binder system to adhere the opaque particulate colorant to the fabric.

17. A process of printing as claimed in claim 16 wherein said making up step includes mixing the colorant, a latex solution, a melamine solution, and thickeners in proportions to achieve a viscosity of about 15,000 +/- 3000 centipoise.

18. A process as claimed in claim 17 wherein said making up step further includes mixing in a catalyst for the latex-melamine binder system.

19. A process as claimed in claim 17 wherein said applying step includes applying the print paste in a wet-on-wet printing process.

20. A process as claimed in claim 19 wherein said wet-on-wet printing process includes the step of applying dyes which dye differently than the print paste.

21. A process as claimed in claim 19 wherein said wet-on-wet printing process includes the step of applying a blotch of dye which dyes differently than the print paste.

22. A process as claimed in claim 21 wherein said blotch is a full blotch.

23. A process as claimed in claim 20 wherein said making up step includes mixing into the print paste a resist which prevents the dyes from dyeing the fabric contacted by the print paste.

24. A process as claimed in claim 20 further comprising fixing the dye after the applying step.

25. A process as claimed in claim 24 wherein said fixing step takes place between said applying and curing steps.

26. A process as claimed in claim 24 wherein said curing step takes place between said applying and fixing steps.

27. A process as claimed in claim 16 wherein said curing step includes exposing the fabric to a temperature of at least about 300 degrees Fahrenheit for at least about three minutes.

28. A process as claimed in claim 16 wherein said making up step includes adding a dye to the print paste.

29. A process as claimed in claim 16 wherein said making up step includes adding a disperse dye to the print paste.

30. A process as claimed claim 16 wherein said applying step includes applying the print paste to the fabric in a screen printing operation, with the screens having holes at least as large as the holes in a 40 mesh screen.

31. A process of printing a napped fabric to achieve a long wearing coloration of the fabric comprising
making up a print paste of an opaque particulate colorant and a latex-melamine binder system including mixing the colorant, a latex solution, a melamine solution, a catalyst for the latex-melamine binder system, a disperse dye, a resist which prevents dyes which dye differently from the

print paste from dyeing the fabric contacted by the print paste and thickeners to achieve a print paste viscosity of about 15,000 +/- 3000 centipois ,

applying the print paste to the fabric in a wet-on-wet printing process including applying dyes which dye differently than the print paste in the form of a blotch which covers some of the colorant,

fixing the dye which dyes differently than the print paste, and

curing the latex-melamine binder system to adhere the opaque particulate colorant to the fabric by exposing the fabric to a temperature of at least about 300 degrees Fahrenheit for at least about three minutes.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US92/04363

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :Please See Extra Sheet.
US CL :
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. :

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A, 2,308,429 (SMITH) 12 January 1943 See the entire document.	1-31

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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03 AUGUST 1992

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER:
IPC (5):

B32B 33/00; B05D 1/36 428/87, 90, 91, 96, 372, 375; 8/115.6; 427/197, 203